

# EXTRACTOR

## THE Metallurgical Engineering Newsletter OF Montana Tech

Another year has come to a close and your old department would like to wish you a Happy New Year that the world celebrated a few weeks back and recently with our Chinese friends. To start the Millenium, here is some news about the Metallurgical Engineering (MetE) Department, the campus, our alumni, etc. Hope to hear back from you.

### Vern Griffiths Retires

Dr. Vernon Griffiths, who is 70 going on 40, announced his retirement two years ago; however, in order to coordinate his retirement with Sam Worcester's retirement and thereby minimize the impact on the campus budget, he graciously said he will wait a year and then go on one-third retirement the last year. This insured that the required laboratory courses of MetE 305 and 306 were continually offered for MetE and Engineering Science (now known as General Engineering) programs. It also allowed Carl Cross the chance to observe how the courses were taught thereby easing his efforts developing the courses when they become his responsibility the following year. Vern's retirement dinner was held at Spaghatini's, a favorite local restaurant, and attended by his family, friends, fellow faculty, and a few company representatives in the area. At the last 1998-1999 faculty meeting, Vern was also honored with a plaque commemorating his 40 years of unselfish service to Montana Tech and, with Board of Regents approval, was granted emeritus status. During graduation ceremonies for the the Class of 1999, he received a print of Montana Tech; the border around the print was signed by all of the faculty and staff on campus.

The following is his brief biography which was submitted with the materials sent to, and unanimously approved by, the faculty and the Board of Regents requesting he be named Professor Emeritus of Metallurgical Engineering: Vern Griffiths was born in Treorchy, Wales on May 4, 1929. He became a naturalized citizen of the USA in 1969. He earned his B Sc. and M Sc. in Metallurgy at the University of Wales, Swansea, in June 1949 and October 1951 respectively. Vern received his Sc D. in Metallurgy with a minor in Nuclear Engineering and Chemistry from Massachusetts Institute of Technology (MIT) in 1955. While at MIT, Vern, along with numerous other students, including Harvard students, was a member of the folk dancing/outing club. Through this club, he met his future wife, Barbara Holm. They were married Oct. 16, 1954 in Quincy, Massachusetts. Congratulations to them on their recent 45<sup>th</sup> anniversary celebration! They have 5

children: Susan Alt, Janet Manchester, Brychan Griffiths, Huw Griffiths, and Evan "Bub" Griffiths.

Vern was employed from 1955-1959 by Sherritt Ltd. at UBC, Vancouver, B.C. Canada. During the same period, he was a Research Associate of Metallurgical Engineering at the University of British Columbia. From 1959 to the present, he served in the capacities of Associate Professor, Professor, and Department Head in Metallurgical Engineering; as the Director of both Research and the Graduate School; and the Executive Director of the Montana Tech Foundation. Outside of Montana Tech, he was the Project Director for MSE's ceramic research project, spent summers working for the Department of Energy at Argonne National Laboratory-West, Idaho Falls, Idaho, attended an advanced scanning electron microscopy and X-ray microanalysis short course at Lehigh University in Pennsylvania; performed research at Johnson Manned Spacecraft Center, Houston, TX; had a faculty NASA-ASEE faculty fellowship at Johnson Manned Spacecraft Center; and attended Energetics in Metallurgical Phenomena at the University of Denver, CO. Vern served as the Director of the Montana Energy Research Development Institute (MERDI). He is a member of the following professional societies: Institute of Materials, ASM International; TMS of AIME; American Ceramic Society; Materials Research Society; the American Powder Metallurgy Institute, Sigma Xi, the National Association of Corrosion Engineers, and the Microbeam Analysis Society.

Dr. Griffiths' fields of expertise include scanning electron microscopy and X-ray microanalysis, X-ray diffraction, metallography, failure analysis, materials selection, and physical metallurgy. His knowledge and insight in these fields are invaluable and have been shared unselfishly with his many students and colleagues through the years. Vern has been active in the area of metallurgical failure analysis for a wide variety of clients.

Vern you will be missed but we hope you will periodically return to teach at Montana Tech. Happy Retirement!

### MetE Gets New Hire!

Dr. Carl E. Cross joined the department in January. Dr. Cross, a Denver native, moved to Butte from Trondheim where he worked as a guest scientist at the Norwegian University of Science and Technology (NTNU). He received his BSc, MSc, and PhD degrees in Metallurgical Engineering from the Colorado School of Mines (CSM), graduating with his

doctorate in 1986. Following graduation, he taught at CSM as an Adjunct Professor for eight years and actively participated in the Center for Welding Research. Carl is a registered PE.

His industrial experience includes four years as a welding engineer with Rockwell International, where he performed

weld development on nuclear weapon components. Among other things, this involved the development of precision electron beam welds on conventional alloys (stainless steel, aluminum), exotic materials (uranium, beryllium), and dissimilar metal alloys. He also spent four years working in aerospace for Martin Marietta, developing welds for the new high strength aluminum-lithium alloy (Alloy 2195) now used on the Space Shuttle. He has also worked as a private consultant, performing contract welding research and failure analysis for numerous corporations and the US Army, and he has given lectures and short courses on welding metallurgy throughout the world.

Following a slump in defense spending in 1994, he moved to Hamburg, Germany, accepting a one-year guest professorship at the University of the Federal Armed Forces. Here he performed research on the hyperbaric (underwater) welding of Duplex Stainless Steel, used in the piping of oil and gas in the North Sea. After one year in Hamburg, and one year in the

States, he moved to NTNU in Norway where he was invited to work on alloy development for welding consumables used for constructing all-aluminum fast ferries.

His mission at Montana Tech is to build upon the existing programs in physical metallurgy, materials and welding thereby filling the shoes of both Vern Griffiths who is fully retiring this year and Sam Worcester who retired two years ago and unfortunately passed away last year. Carl is also developing new courses in solidification and casting and failure analysis. Plus, he is working to establish a strong graduate research program in the welding, joining and casting of advanced materials.

Dr. Cross has slid into the position with relative ease. The Metallurgical Engineering Program has been changed slightly to accommodate his areas of expertise as will be discussed later. He is a great asset to the Department. Welcome aboard Carl!

### **Larry Twidwell Nominated for National Awards**

Larry Twidwell has been nominated by MetE Department Head Courtney Young for two national awards: the TMS Educator Award and AIME Minerals Educator Award. If you have ever had Larry for an instructor, than you would know what an effective teacher he is. If you have the time and are willing, MetE would like you to write recommendation letters on his behalf. Here are the addresses:

The Minerals, Metals & Materials Society  
c/o TMS Educator Award Committee  
184 Thorn Hill Road  
Warrendale PA 15086  
Telephone: (724) 776-9000

American Institute of Mining, Metallurgical and  
Petroleum Engineers  
c/o AIME Minerals Educator Award Committee  
Three Park Avenue  
New York NY 10016-5998  
Telephone: (212) 419-7676

The TMS Educator Award recognizes an individual who has made outstanding contributions to education in metallurgical engineering and/or materials science and engineering based on demonstrated contributions to education and is not limited to classroom teachers but also considers contributions through writing of textbooks, building of strong academic programs, outreach to high school students, or innovative ways of educating the general populace. His citation for this award reads "in recognition of his distinguished contributions in extractive metallurgy for devoted and unselfish teaching, for thorough reviews of unit processes via modular tutorials, and for innovative solutions to environmental problems." The AIME Mineral Industry Education Award was established in 1960 and is given for distinguished contributions to the advancement of mineral industry education. His citation for this award reads "to recognize his significant contributions to the mineral industry for devoted and unselfish teaching in extractive metallurgy and innovative use of the technology for solving environmental problems." Thanks in advance for your time and effort. Good luck to you Larry!

### **Annual Phonathon – A Winner Again!**

Budget constraints have not only made it difficult to replace retiring faculty, it has also made it difficult to run the department as effectively as times past. Unfortunately, we have to rely more and more on our alumni. Thanks to your kind donations this year and in the past, we will be able to continue meeting the needs of our students. This year, the Montana Tech Foundation Annual Phonathon (in coordination with the departmental fund-raising letter) raised over \$14,000 for MetE nearly \$3,000 over the previous year. The

department spent one night making the phone calls and helped raise \$6,000. Courtney spent at least one night a week during the five-week period raising over \$6,000 himself. Carl spent three nights calling and raised \$3,000. Some of the money pledged to MetE went unrestricted but most was designated for the Metallurgical Engineering Student Excellence Program (MESEP). Thanks for meeting our increased-pledge challenge and hope you can do it again in the years to come. Your support is greatly appreciated. Thanks again!

### **Faculty and Staff News**

*Larry Twidwell, Professor and Anaconda Distinguished Professor of Metallurgical Engineering.* The past year has

been very interesting for Larry. Not only has he taught seven courses (Pyrometallurgy, Corrosion, Metallurgical

Thermodynamics, Arsenic Control in Metallurgy, Ternary Phase Diagrams, Flowsheet Design, and Gold Processing), he has directed the graduate studies of four M.Sc. students. His research activities, including the work with the graduate students, have included assisting MSE in the startup of a full scale arsenic removal process at a site in California utilizing technology he developed at Montana Tech; conducting a pilot scale demonstration with MSE at Kennocott for removing selenium from discharge waters; working with MONTEC to develop new methods for extracting gold from refractory ores and separating mercury from contaminated materials; directing the MWTP projects on Berkeley Pitlake sediments and on thallium removal from wastewaters; and teaming with MSE and the Utah Department of Environmental Quality to present a proposal to the American Water Works Research Foundation (\$500,000). Clearly, Larry continues to be the most research-active member of the MetE Department. His continued involvement with the local companies (MSE Inc. and MONTEC) and the MWTP on campus has been highly-supported and produced five final reports as well as seven theses of which three remain in progress: Ray Ziolkowski (BS 1997) is expected to finish his MWTP study on Berkeley Pitlake sediments in May as is Eric Dahlgren (BS 1999) who is on the MONTEC project. Catherine Williams-Beam will likely finish her MS with the thallium removal project in December of 2000. It is important to emphasize that Dr. Twidwell's research on arsenic removal from wastewaters has been adopted by MSE and implemented into a full scale operating facility. This facility is a one-of-a-kind in the world and is capable of lowering arsenic concentrations in wastewaters to less than one microgram/liter (1 ppb). Michelle Gale (MS 1998), Paul Miranda (MS 1997) and Ray Ziolkowski have all been involved in the implementation which has been directed by another Montana Tech engineer, Jay McCloskey (MS 1991) who is presently a Senior Process Engineer at MSE. Larry presented a paper on the Berkeley Pitlake sediments which involved co-authors Dr. Courtney Young and Dick Berg (MBMG) at the MWTP Spring Meeting in Salt Lake City. He also presented some of his mercury research at Akita University (our sister university) in Akita, Japan. Larry assisted Courtney in soliciting and reviewing papers for the upcoming Minor Elements Symposium (SME) in Salt Lake City in February, 2000, for which he also prepared a paper and will chair a session. He additionally presented three papers (dealing with arsenic, selenium and mercury removal from process and industrial wastewaters) and co-chaired two sessions at the REWAS'99 conference in San Sabastian, Spain. Finally, he and Dr. Corby Anderson visited the gold fields of Nevada where they met many Montana Tech graduates. The tours were excellent and, of course, provided valuable additional course materials for various courses particularly Arsenic Control and Gold Processing.

**Hsin-Hsiung Huang, Professor.** H<sup>3</sup>, as he is sometimes known, concluded investigating an ammonium leach technology for recovering the valuable metals such as copper and zinc from sludges precipitated during the two-stage precipitation process, the EPA-BDAT for treating ARD. His student on the project, Brian Park, works at MSE and graduated this past May. H<sup>3</sup> continues to consult for ASiMI and is currently working towards a solution regarding a water-corrosion problem they are experiencing. The work involves extensive use of MetE's computer-controlled

potentiostat/galvanostat purchased last year and also makes good use of his STABCAL program, a software program for thermodynamic modeling of aqueous systems. The world-renowned program can, for example, calculate speciation diagrams such as E<sub>H</sub>-pH, log<sub>a<sub>i</sub></sub>-pH, and log<sub>a<sub>i</sub></sub>-log<sub>a<sub>j</sub></sub>; determine adsorption isotherms; and simulate titration experiments; each with or without mass-balanced constraints and, just recently, in three dimensions if so desired (e.g., E<sub>H</sub>-pH-log<sub>a<sub>i</sub></sub>). The program is PC-compatible and can be obtained in Windows-format. STABCAL is currently being used in industry particularly for metallurgical, geological and chemical applications. Furthermore, the program was used successfully in numerous research efforts across campus but predominantly in the MetE department. Dr. Huang continues to modify STABCAL and all anxiously await what he will come up with next. He offers a short course on the use of STABCAL at least once every two years to demonstrate how best to use it as well as to inform users of his recent modifications. The short course this year was during the intersession and was scheduled from 8:30am – 12:30pm from January 10 – 12. It was coupled with the short course taught by Bob Robins as discussed later.

**Carl Cross, Professor.** Dr. Carl E. Cross, who was hired in January of this year as noted above, has actively assumed his teaching duties and has been busy preparing notes for his new courses. He is fast becoming familiar with committee duties, currently serving on three committees. In addition, he took over advising responsibilities for John Stevenson and was a member of Terry Caetano's defense committee. Both successfully defended their non-thesis MS programs in Metallurgical Engineering and graduated this past May. He plans to continue this trend with thesis majors and consequently has begun the research. He successfully won a new faculty seed grant proposal, which enabled him to purchase some state-of-the-art welding equipment to begin developing his weldability laboratory. This equipment will be used by senior student Israel Jessop to perform his undergraduate research program (URP) project sponsored by the Undergraduate Research Committee. In addition, he prepared two proposals over summer break: a DEPSCOR submitted to the US Navy (to fund weld development studies on aluminum armor Alloy 2519) and a white paper submitted to Lockheed-Martin (to fund weldability studies on aluminum-lithium Alloy 2195 used on the Space Shuttle). Dr. Cross has had two technical papers published this year; one in *Scripta Materialia* (v. 40, pp. 1139-1144) and one in *Science and Technology of Welding and Joining* (v. 4, pp. 381-388). He also spent a large part of his summer preparing a manuscript that will become the chapter of a book on aluminum manufacturing, to be published by ASM International. Dr. Cross presented an invited paper at the Materials Research Society Fall Conference in Boston, to be published in conference proceedings. He also presented a seminar at the Colorado School of Mines as part of an effort to establish collaborative projects between the schools. He continues to be active with the American Welding Society, attending their annual convention in St. Louis and serving as a principle reviewer for the *Welding Journal*. Presently, he is interacting with MSE to establish a cooperative research agreement for modeling the distribution of particles during the centrifugal casting of aluminum metal matrix composites. On the lighter side, he recently presented a lecture at the Montana Tech Sigma Xi seminar series, talking on the historical aspects of

mining and metallurgical traditions in Norway. Carl has adjusted to a new educational system and is a most welcome member to our department.

**Corby Anderson, CAMP Director and Research Faculty of Metallurgical Engineering.** As Director of The Center for Advanced Mineral and Metallurgical Processing, Dr. Corby Anderson carried out approximately 30 projects with industrial clients over the past academic year employing about 15 Metallurgy undergraduate and graduate students to help facilitate the work. Dr. Anderson was again an integral part of the Department of Metallurgy, teaching classes in addition to his responsibilities at CAMP. In the Spring, he will teach MetE 471 X-ray Diffraction. In addition, he served as advisor to two senior design projects involving bi-sulfide leaching and zeolite processing, one of which came from a CAMP client. He also assisted in advising on two undergraduate research projects (Shamus O'Keefe and Eric Dahlgren) as well as sitting on two thesis committees (Brian Park and Steve Thurmond). His accomplishments outside of the academic realm of Montana Tech include: being a member of the Board of Directors for IPMI and SME; being a trustee for NWMA; serving on the National Materials Advisory Board; being elected to the Mining and Metallurgical Society of America; presenting 7 papers at several technical conferences; acting as session chair for SME, TMS-REWAS, and IPMI; acting as Technical Chairman for IPMI 23rd Annual Meeting, co-organizer of the Minor Elements 2000 Symposium, and co-organizer of the Mineral Processing Plant Design Update 2000 - Practice and Control. He too will present and chair at the Minor Elements 2000 Symposium. Clearly, MetE and CAMP work together to provide industry answers to their questions. The work is often facilitated through MetE 477, the senior design capstone course. A goal of the department is to make this more of a reality. This is presently being done. Furthermore, CAMP is now consistently being called upon for numerous opportunities. Together, with all the consulting and research activities noted above, MetE's and CAMP's professional and public relationships with industry continue to develop and blossom.

**Tami Patrick, CAMP Office Assistant.** Tami joined CAMP nearly three years ago and recently moved her office into ELC 225 to be near Corby and the MetE department. She is a huge reason why CAMP has had its successes and, just as importantly, no failures. Tami is a native of Butte and earned a BA in Recreation from Northwest Nazarene University, Nampa Idaho in 1994. She came back to Butte when she married MetE alumni DJ Patrick (BS 95). She has continued her education at Tech as a Post Bac student and has taken several business courses applying what she learns to her position with CAMP. The business courses she takes are required pre-professional courses for acceptance into Graduate School; she plans to obtain an MBA from the Off-Campus MBA program offered through The University of Montana. Her accomplishments working at CAMP include creating an accounting system, creating and maintaining a web page for CAMP ([www.mtech.edu/CAMP](http://www.mtech.edu/CAMP)), creating a comprehensive marketing plan, and maintaining a Statement of Qualifications as well as many marketing items such as brochures, flyers etc. She has also had a project of her own involving a library search for a client and another project which will involve

putting the holdings of the IPMI Library, which CAMP houses, on the web is pending.

**Rosalie Murphy, MetE Office Assistant.** Rosalie has been with the MetE department for 20 years. Other departments and programs have tried to steal her away but she loves MetE kids, faculty and, of course, alumni too much to really consider it. That's good too! We all wish she could stay on for another 20 years; however she too has discussed retiring with her husband Jim, but at least will stay on for a while. In addition to her secretarial duties, she completed Microsoft short courses in Word and Excel and is learning Front Page software, which will be used to edit MetE's web page. She has completed a training session in the use of Blackboard software, which can be used to make course materials available on the Montana Tech web site. Perhaps soon you can take another class from us but this time in your own home.

**Courtney Young, Department Head and ASARCO Distinguished Professor of Metallurgical Engineering.** Dr. Courtney Young spent most of his time this past year on research and service. His research efforts have currently centered around using photolysis for cyanide destruction and acid-rock drainage (ARD) remediation. His efforts culminated in three publications and two presentations and are primarily funded through the Mine Waste Technology Program (MWTP) and partly through the Undergraduate Research Program (URP). Marty Bennett successfully defended his Berkeley Pitlake surface waters research and will be the third student of his to receive a Master's degree from the MWTP. Tom McMillan will be next and will attempt to improve on the technology for selective removal of metal constituents from ARD. Dr. Young recently submitted an Article to the Research Office to discuss these efforts. Courtney continues to chair the thesis research of Krag Filius and Dave Fowler., both of whom are MSE employees. Krag is expected to graduate in May of 2000 and Dave just recently started the program and is involved in a project aimed at improving column flotation technology. This past year, Courtney assisted five students in their undergraduate research efforts: Matt Griffith (BS 1999), Israel Jessop, Shamus O'Keefe (BS 1999), Eric Dahlgren (BS 1999) and Kevin Ritari (BS 1999). Jessop, who was one of two students to represent Montana Tech at the National Undergraduate Research Conference held just recently in New York, will graduate this May and is currently working with Carl on another URP project. Dahlgren enjoyed conducting research and consequently stayed on for graduate school under the guidance of Larry Twidwell. With the help of Dr. Corby Anderson, Dahlgren and O'Keefe continued their efforts to help fulfill obligations for senior design projects. This particular project is likely to be funded further by a major gold-mining company. Courtney also entered into agreement with South Dakota School of Mines and Technology and the University of Idaho to form a Consortium between the respective MetE departments. The Consortium is envisioned to use long-distance education among common course offerings and thereby free up time for instructors to pursue research efforts and/or other scholarly activities. Chancellor Gillmore agreed to support the Consortium and a proposal for over \$1M was submitted to NSF-EPSCoR but is presently unfunded. Currently, Courtney is assisting three other undergraduates with their URP research: Shonna D'Hooge,

Joslyn Hunt, and Andy Hadden. Shonna and Joslyn together are thermodynamically quantifying the adsorption of Fe, Al and Mn at silicate mineral surfaces. Andy is examining ways to purify certain minerals in various mine tailings. These minerals were once considered waste but are becoming marketable as industrial minerals.

Due to ongoing research efforts involving cyanide destruction, Courtney also became recognized as an expert in its use for silver and gold leaching. His presence was often requested by the State Legislature and other entities (MMA, NWMA, Chicago Tribune, etc.) to ascertain the facts on cyanide due to an initiative (I-137) being hotly contested. Although the initiative passed, his efforts along with those of Rob McCullough in the Montana Bureau of Mines and Geology (MBMG) helped minimize its impact. Their efforts though are far from over as there is a pending lawsuit. Courtney was also contacted by the Montana Standard to see if he could deliver 100 pounds of "Montana-made" copper for minting into coins. A beat-up 200-pound cathode originally made by the Anaconda Copper Company at their refinery in Great Falls was delivered to the Montana Standard and highly publicized. The coins were made to commemorate the millennium and were to be designed by the winning artist of a contest that Courtney helped judge. The coins (silver versions as well) can still be purchased from the Montana Standard. This coin project led to a second project with Montana Resources for a senior design group to produce high-quality copper from their cemented copper product. If you have a project in mind and would like CAMP and/or the MetE seniors to pursue it in their senior design class, please do not hesitate to contact the department!

**Vern Griffiths, Professor.** Vern retired in May of 1999 and is on one-third time through May of 2000. In his last year, he taught or will teach Metallographic Interpretation and Physical Metallurgy Lab which are the required lab courses in the undergraduate program and will continue to be taught, among others, by Carl Cross. You might recall that these lab courses are additionally taken by E.S. Welding students which typically means three sections need to be offered in order to overcome bottlenecks for polishing and for microscope usage. It is important to note that, without the semi-automatic polishing machines, it would not have been possible to prepare specimens for the lab courses; your kind financial support of

the MetE program makes this and efforts like it in other courses possible! Thanks. With much of Vern's time consumed on these two courses, it is incredible that he offers to teach his two favorite subjects as well: SEM/EDX and Failure Analysis. The former is becoming more difficult because the age of the SEM (it is 20 years old) and the latter more-and-more interesting due to the steady trickle of failure analysis consulting jobs he lands which make for interesting class discussions as well as publications/presentations. In this regard, he gave a well-received talk to the 1999 NACE Williston Basin section annual meeting in Billings. He also completed two court cases as an expert witness, worked with Professor Emeritus Dr. Gordon Zucker to determine various properties of a new super-strength alloy, and worked for two local companies (ASiMI and Golden Sunlight) to solve physical metallurgy problems they recently encountered. He chaired the committee that saw Terry Caetano defend his non-thesis program. Finally, Vern continues to win battles that keep the SEM and the submerged cut-off saw in operation. Both machines are older than most of the students (ab)using them. Due to the amount of time Vern puts into these courses, one might think that the only thing that really changed this year was his one-third paycheck! Clearly, he is unselfish and totally dedicated to the students and, like the rest of us, it's the love of teaching and the interaction with the students which provides the drive, though the quaint and unique remarks that he pens on tests and laboratory reports might also have something to do with that (?). It is ironic to note that some students from Vern's early years in the department beat Vern to retirement!

**Bill Huestis, MetE Lab Director.** William "Bill" Huestis instructs our mineral processing labs including the service labs to Mining and Geological Engineering students. However, due to the impending full-retirement of Vern, his laboratory instruction load is set to increase in order that the physical metallurgy labs continue to be offered. In this regard, current plans are to have Carl Cross give the lab lectures and Bill instruct the lab exercises. His hands-on, mechanical expertise at maintenance and repair, his help on research projects and his analytical skills with the XRD scanning goniometer, ICP, ion-chromatograph, and SEM/EDX continue to be invaluable. Without Bill, mineral processing courses at Montana Tech simply could not be as effective; unfortunately, that seems to be the way the physical metallurgy courses are headed too.

## Curricular Changes to MetE Program

Due to Courtney becoming Department Head, Vern not being replaced, and Carl being a new hire so his areas of expertise could be taken advantage of, it became necessary to restructure the MetE program. After interviewing undergraduates including graduating seniors, conducting polls with alumni who graduated less than 6 years ago, and working with several other constituents including CAMP and the MetE Advisory Board, a variety of changes were submitted and approved by the campus. These changes included adding five new courses (MetE 252, 404, 441, 444 and 469) of which only one (MetE 404) would not be required. MetE 252,

Fundamentals of Physical Metallurgy, was needed to improve the transition from MetE 202 and 305 to MetE 306 and 352. This course effectively replaces MetE 351 which was canceled when Sam Worcester became Department Head. MetE 404, Fire Assay, was added based on industry demand and will be offered as a short course during the summer or intersession only. MetE 441, Flowsheet Design, will be offered every other year in rotation with MetE 423, Ternary Phase Diagrams. MetE 444, Casting and Solidification, and MetE 469, Failure Analysis and Design Life, will also be alternated and are included based on industry demand. See next page.

<b>FRESHMAN</b>				<b>SOPHOMORE</b>			
<i>Fall Semester</i>			<u>Cr.</u>	<i>Fall Semester</i>			<u>Cr.</u>
Chem.	105	General Chemistry	3	Econ	260	Principles of Economics	3
Chem.	113	General Chemistry Lab I	1	E.S.	205	Statics	3
Engl	104	English Composition	3	Math	251	Calculus III	4
Math	152	Calculus I	3	MetE	232	Processing Technology	3
Min	101	Intro. to Eng. Calculations & Problems	3	Phys	207	Gen Phys.-Heat,Sound, & Optics	3
		Humanities Elective	<u>3</u>	Phys	209	Physics Laboratory	<u>1</u>
		<i>Total</i>	<i>16</i>			<i>Total</i>	<i>17</i>
<i>Spring Semester</i>			<u>Cr.</u>	<i>Spring Semester</i>			<u>Cr.</u>
Chem.	106	General Chemistry	3	Math	223	Differential Equations	3
Chem.	116	General Chemistry Lab II	1	MetE	233	Size Reduction and Classification	3
Math	153	Calculus II	3	MetE	252	Fund. Physical Metallurgy	3
MetE	202	Intro to Met & Mat Engineering	3	MetE	301	Momentum & Heat Transfer	3
Phys.	104	General Physics-Mechanics	3	MetE	322	Metallurgical Thermodynamics	3
		Humanities Elective	<u>3</u>	Phys	208	Gen. Phys.-Elect, Mag, & Wave	3
		<i>Total</i>	<i><u>16</u></i>	Phys	210	Physics Laboratory	<u>1</u>
						<i>Total</i>	<i><u>19</u></i>
<b>Freshman Total</b>			<b>32</b>	<b>Sophomore Total</b>			<b>36</b>
<b>JUNIOR</b>				<b>SENIOR</b>			
<i>Fall Semester</i>			<u>Cr.</u>	<i>Fall Semester</i>			<u>Cr.</u>
Chem	335	Physical Chemistry	3	E.S.	445	Instrumentation & Control	4
Chem	337	Physical Chemistry Laboratory	1	MetE	405	Extractive Metallurgy Laboratory	1
E.S.	321	Scientific and Technical Writing	3	MetE	453	Senior Seminar	1
E.S.	335	Mechanics of Materials	3	MetE	471	Metallurgical Analysis	3
MetE	304	Metallurgical Kinetics	3	MetE	475	Corrosion & Oxidation	3
MetE	305	Metallographic Interpretation Lab	1			Technical Electives*	3
MetE	352	Materials Engineering & Design	<u>3</u>			Social Science Elective	<u>3</u>
		<i>Total</i>	<i>17</i>			<i>Total</i>	<i>18</i>
<i>Spring Semester</i>			<u>Cr.</u>	<i>Spring Semester</i>			<u>Cr.</u>
E.S.	336	Mechanics of Materials Lab	1	E.S.	404	Professional Engineering	1
E.S.	353	Electrical Circuits & Power	3	MetE	411	Materials Handling Design	OR
Math	331	Statistics	3	MetE	444	Casting & Solidification	OR
M.EC	363	Eng. Economy & Financial Mgmt.	3	MetE	469	Failure Analysis & Design Life	3
MetE	302	Pyrometallurgy	2	MetE	423	Ternary Phase Diagrams	OR
MetE	306	Materials & Physical Metallurgy Lab	1	MetE	441	Flowsheet Design	3
MetE	401	Hydrometallurgy I	<u>3</u>	MetE	477	Senior Design	3
		<i>Total</i>	<i><u>16</u></i>			Technical Electives*	4
						Social Science Elective	<u>3</u>
						<i>Total</i>	<i><u>17</u></i>
<b>Junior Total</b>			<b>33</b>	<b>Senior Total</b>			<b>35</b>

Minimum Credits for B.S. degree in Metallurgical Engineering

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\*Departmental approval is required for all technical electives. Of the 7 technical electives, 3 must have a significant engineering design component. PERMISSIBLE TECHNICAL ELECTIVES include Min 105, EnvE 204, GeoE 204, Chem 221, and any course numbered 300 or higher in Chem, E.S., EnvE, GeoE, GeoP, Math, MetE, Min, or M.Ec. Mineral Processing/Extractive Metallurgy students should consider MetE 412, 420, 425, 434, 482 and 483; Welding Metallurgy/Physical Metallurgy students should consider MetE 420, 470, 490 and 491; and Materials Engineering students should consider MetE 462, 470, 484 and 486. All students should also consider completing Minors in Chemistry and Math.

As can be seen, the new program remains flexible by giving students a choice between certain courses as just noted and still allows for technical electives to be chosen although only for seven credits. Other changes include requiring MetE 233, Size Reduction and Classification, but like MetE 232, Processing Technology now includes a lab credit and, as a result, the MetE 325 and 326, Mineral Processing Labs I and II were canceled. Also, MetE 322, Metallurgical Thermodynamics, was moved to the sophomore year so that it would be taken before Chem 335, Physical Chemistry, and MetE 304, Metallurgical Kinetics. MetE 304 credit requirements were increased from 2 to 3 so that solid state diffusion, transformations, etc. could be included. Likewise, the credit requirements in MetE 471, Metallurgical Analysis,

were increased from 2 to 3 to incorporate SEM/EDX which was previously listed as MetE 593 but was canceled. Similarly, MetE 401, Hydrometallurgy I, was moved to the junior year to better meet the demands for internships. Finally, MetE 451, Process Instrumentation and Control, was canceled in favor of E.S. 445, Instrumentation and Control, which includes a hands-on lab as well. Material no longer covered will be incorporated into MetE 411, Materials Handling and Design, and MetE 434, Separation Processes. Other minor changes included renaming and renumbering courses as well as revising course descriptions. The program is just as strong as before but the loss of technical electives and the inability to replace Vern means that true materials-type courses will not be offered consistently in the near future.

## Intersession and Summer Courses

**Gordon Zucker Returns.** For the past two years, Emeritus Professor Dr. Gordon Zucker has returned to teach during the intersession that runs for two weeks in January between the Spring and Fall Semesters. The irony is that one of the reasons Gordon retired in 1994 was because of re-occurring problems from the frostbite he got during his stints in the Korean War; Butte was simply getting too cold for him anymore. Although it is only for a short time, he is welcome back at any time, even if it is the coldest month in Butte! This year, intersession ran from January 3 to January 14. He came back to teach MetE 233 – Size Reduction and Classification, a course which is important to mineral processing/extractive metallurgy type students but could not be offered the past several years since Dr. Courtney Young became Department Head and no one else was available to teach the course. Now that the program has gone through a major restructuring, that is no longer the case and this important course is now required as just discussed. The previous year, Gordon returned to teach a Special Topics course on Industrial Minerals Processing. That course was very popular with 18 students enrolled.

**Bob Robins Visits.** During the past year, Robert “Bob” Robins visited MetE three times from his home in Sydney Australia. He began visiting Butte and Montana Tech in 1985 when he heard that the Berkeley Pit was flooding. He has been visiting regularly ever since and always noting the changes in the Pitlake and, of course, getting involved in experiments and decisions regarding its future. During these visits, he has worked closely with Larry, Courtney and H<sup>3</sup> on arsenic, cyanide, ARD, and other environmental issues. As a result, he later became heavily involved with both the MWTP and MSE. During the 1999 SME Annual Meeting in March, Bob received the Wadsworth Extractive Metallurgy Award for

which Courtney and Larry nominated him. Afterwards Bob stopped by for a few weeks to help coordinate efforts for the Minor Elements 2000 Symposium at the 2000 SME Annual Meeting. He returned in August for a few weeks at the invitation of the MWTP and additionally helped review and edit the manuscripts submitted for publication in the symposium proceedings. He then returned in late December to enjoy the Millennium change with us and teach a short course during the intersession, MetE 466 – Chemical Speciation and Equilibrium Modeling. Afterwards, he will work with MetE as well as MSE and hopes to receive funding through the SME Meeting where he is scheduled to present several papers including one with Courtney. The intersession course is additionally offered to industry.

**Future Offerings.** CAMP and MetE have worked closely together to offer short courses and often times are able to bring in various groups or companies. Lately, this has included JK MRC representatives who come in to teach their software products: JKSymMet and JKFloat. They typically like to come every other year and may make an appearance for a third time in late this summer or early fall. Similarly, preparations are underway with PERI personnel to bring them in this May for the first time to teach their flowsheet design and modeling program. H<sup>3</sup> just taught a short-course on STABCAL this past intersession and is always willing to do it again provided enrollment would be adequate. Corby is taking the lead on working with area industry and IPMI members to organize the Fire Assay course for the summer and/or intersession. Typically, these courses run every other year but scheduling is not set in stone. More importantly, they are available to industry not just students. If you are interested in any of these or other courses, please let MetE or CAMP know.

## Budget Funding Sparks Recruiting, Scholarship and Endowment Drives

The Board of Regents (BOR) have been making changes to the Montana University System (MUS) for several years. The most noteworthy occurred a few years ago when the MUS was restructured into a two-university system putting Montana College of Mineral Science and Technology under the jurisdiction of The University of Montana and renaming it to

Montana Tech of The University of Montana. Recently, however, the BOR began a new policy in which funding would be determined by the number of full-time students (full-time equivalents or FTE's) at each school. The BOR would give each school funding based on enrollment projections. If those projections were not met, some funding would have to

be returned. Montana Tech was hit with a \$400K deficit. As a result, budgets across the campus are constrained and replacing faculty is becoming impossible, including Vern, unfortunately. Low enrollment programs like MetE need to increase their FTE's or face the consequences of maintaining low faculty/staff numbers or, at worst, closing their doors. Furthermore, tree-hugger type activities are also making things difficult; the passage of I-137 is but an example. In this regard, a major campaign will soon be implemented to ask alumni to recruit students in their local areas to attend Montana Tech (and of course MetE!), establish new

scholarships, and endow positions across the campus, particularly those in The School of Mines, including Vern's. If you think you can help or help champion such causes with a company or an individual, please contact Chris Van Nuland in the Alumni Relations Office at (800)445-8324 for the recruiting efforts and Jim Peak and/or Jay Vogelsang in the Montana Tech Foundation at (800)984-4683 for the scholarship and endowment opportunities. Partial endowments of \$150K are needed at a minimum but estimates show that fully endowed professorships will take about \$1.5M per. Yikes, this is an expensive endeavor!

## Department News

**Equipment Donations.** Many thanks are offered to the companies and individuals who go out of their way donating equipment to help us meet the educational demands of both the students and industry. Kennecott Utah Copper Company kindly donated an X-Ray Fluorescence (XRF) unit for measuring copper, iron, molybdenum, etc. assays in a slurry on-line. The unit will hopefully be incorporated into MetE 456, Separations Lab this Spring but eventually in MetE 434, Separation Processes, as part of at least one lab exercise. In hopes that the Fire Assay course would become hands-on, MetE accepted another kind donation, two fire-assay furnaces and air-filtration systems, from Stillwater Mining Company. Facilities have yet to be constructed but first environmental, health and safety issues surrounding lead emissions must be addressed and will take a while. In the meantime, plans for the intersession/summer course are progressing as already noted. CAMP also received two PARR stainless steel autoclaves for the department. One of 8-liter capacity is from Sunshine Mining Company and the other of 2-liter capacity is from CAMP itself. The two autoclaves match well with the existing 2-liter capacity titanium autoclave and have seen and are seeing extensive use in research efforts. Thanks again!

**Book Donations.** In memory of Ted "Shine" Jordan, the Department's Library was renamed and dedicated on October 16, 1998. Approximately 50 members of Ted's family and friends were in attendance. The Library sports beautiful new oak bookcases that were built to specification by Montana Tech's Physical Plant. Books donated to the Metallurgical Engineering Department are usually placed on the shelves in the Ted Jordan Memorial. Recent donations include Sam Worcester's collection of materials engineering and welding books from his wife Kathryn, Mr. Harold Treweek's collection of mineral processing and metallurgical engineering books from his wife Jessie, and Mr. Russel E. Hoar's collection of mineral processing from his wife, Emily Wilson, and son, Kenneth A. Hoar. Robert "Ray" Beebe was also a kind donor of a few valuable books in these extractive disciplines.

**Student Placement.** The department continues to have 100% placement! One undergraduate was unable to find a position but felt becoming further educated was best anyways and elected to do so. This winter, five other undergraduates finished and all were placed. Another eight will graduate this May and only two are still looking! This sure is a good sign that the metallurgy field is looking up and our graduates will

have increased demand. In this regard, we have just three students left (four if you count graduate students) looking for a position so if you hear or know of an opening, please let us know.

A great success story needs to be told though because there is a good moral to it. One student was having difficulty being placed and, at the urging of her advisor, decided to take a summer job. This way that student remained professionally active and simultaneously helped the company through a needy time and additionally maintained a strong relationship between the school and the company. The student let the company know her situation and on several occasions was allowed to leave on interview trips. On the last trip after four months, the student signed a contract for \$46K, \$3K signing bonus, all moving expenses paid, and a year-end bonus of \$3K pending performance. Patience is a virtue!

**Student Highlights.** The 1999 SME Annual Meeting in Denver this past year was attended by eight students, all of whom helped man the booth in the Exhibition. The next meeting in Salt Lake City is expected to have the same number in attendance. The Andersen-Carlyle Student Chapter submitted their Annual Report to SME but, for the first time in a long time, did not place in the award competition in spite of being more organized. Efforts continue to get the Environmental Engineering and Occupational Safety and Health departments involved since they have divisions that they can identify with in SME. Unfortunately, the 1999 TMS Annual Meeting in San Diego was held at the same time and no students were in attendance. The students have promised that they will submit a report to TMS and re-activate their chapter. The report is due in June. This past semester, the department decided to have seminar run like a symposium. In this regard, students submitted abstracts that were edited, ordered and then published and distributed. A few snafus along the way occurred but the symposium was excellent! Because of the success, there will be an earlier and wider distribution of the abstracts next time, particularly to recruit "undecided" students and to invite industry. Israel Jessop, who will graduate this May, was one of two undergraduates to represent Montana Tech at the National Undergraduate Research Conference held in upstate New York in April. He gave a talk on his research experience with Courtney regarding the use of silicate adsorbents for acid-rock drainage remediation. Israel also represented Montana Tech in July as one of just 6 undergraduates nationwide selected by ASM to

attend the Leadership Institute at the Allerton Conference Center in Champaign, Illinois. Kelcey Eccleston (BS '99) was the recipient of SME/MPD Scholarship. She is now a graduate student at CSM. Jennifer Conning, a sophomore, is the recipient of the prestigious Copper Club Scholarship, which will be awarded during her junior and senior years. Finally, three Montana Tech graduate students, including Catherine Williams-Beam who is a student of Larry's, have had abstracts accepted to present at the 31<sup>st</sup> International Geological Congress in Rio de Janeiro, Brazil, August 6-17, 2000. Today, industries are developing relationships and technologies on an international level to gain knowledge and step towards more responsible production. Implementation of these relationships and technologies allows for more efficient use of resources in an environmentally sustainable manner.

**Advisory Board.** Currently, the MetE advisory board includes the MetE faculty, Corby Anderson, Ray Beebe, John Hager, Wally Schultz, Kathleen Kitto, Richard Sutherlin, Frank Aplan, Mike Eiselein, Don McMillan, Milton Wadsworth, and Jay Waterman. Because ABET and the School of Mines prefers to see a larger board, additional members were nominated and asked to join. New members include Gary Tuss, Ken Han, Greg Roset, Pat Taylor, Ed Dowling, and Rob Stephens. Other members will be added later in the semester. As can be seen, the board consists of academia and industry people. They meet with the faculty and staff of the department typically in May the week before or during graduation on a Saturday morning to discuss and often take action on many of the items noted in this newsletter. Because very little funding is available to support travel costs of the members, MetE is very appreciative of the time and effort that they volunteer. Other times for meetings more beneficial to the board will be discussed and may include the SME Annual Meeting and possibly even a second meeting in the year, such that members would make one but not necessarily both.

#### **Accreditation and Assessment**

Courtney pulled together the information supplied by the MetE faculty and staff and wrote, with Rosalie doing the typing, the ABET Volume II report and provided necessary follow-up information to the Engineering Accreditation Committee. You might like to hear that MetE received an NGR evaluation for the first time in 12 years! This means that MetE will not undergo ABET accreditation again for 6 years (in 2005). The next visit will be under 2000 Criteria which are very different from the old criteria. Without going into details, the new criteria require Metallurgical and Materials Engineering programs to give students an integrated understanding of the four major elements in the field: structure, properties, processing and performance. This is what the term "a-k criteria" refers. MetE must also "assess" the program to obtain feedback from the students and other constituency groups (CAMP, Advisory Board, Alumni, Graduate Employers, etc.) and to act on the feedback. This includes doing course/instructor evaluations, peer reviews, student surveys, senior exit interviews, alumni polls, etc. Most of this is being done and, of course, is very tedious. However, as noted already, much of this is already underway and is partly why the MetE program was modified. The NorthWest Regional Accreditation Committee will be visiting in April to evaluate the campus as a whole not by individual programs. Because they pay a lot of attention to assessment, all of the

assessment work done to date will be put to good use. If you participated in any of the assessments, THANKS!

**Campus News.** After serving a year as interim-VCAAR and helping the engineering programs with ABET accreditation, Dan Bradley was named VCAAR. He was appointed by Chancellor Gilmore from a list of three candidates, including two from off-campus that were recommended by a search committee. This past year has also been a very big year for renovations on the campus. The old Metallurgy building was remodeled and renamed the Chemistry/Biology Building in honor of the two departments it currently houses. The Mill Building, which sat vacant for several years and was previously used for fire assay, is now home to the Bookstore, a few conference/meeting rooms, and Montana's first and so far only Starbucks coffee shop. Mineral samples may no longer be ground in there but at least coffee is and good coffee at that! Hence the name still fits. Modernization also hit the Student Union Building, which is still home to the Mail Room/Copy Center, ASMT, and KSMT Radio as well as the four older conference/meeting rooms (Digger Den, Pintlar, Big Butte and Highlands). However, it additionally has a revamped food service, three new conference rooms named after some of the old underground mines (Mt Con, Kelley and Orphan Girl), and three study rooms. The new rooms are complete with computer hook-ups. Finally, a new residence hall was recently commissioned and expected to help increase freshman enrollment.

**Alumni News.** **Frank Panisko**, B.S., Metallurgical Engineering, 1963, who is employed as a Senior Engineer at PNNL, Battelle, is presently working on nuclear reactor fuel performance and reactor safety. PNNL staff members are also studying bioremediation.

**Kunfu Chuang**, M.S., Metallurgical Engineering, 1994, returned to Taiwan and is working for a semiconductor company which makes several kinds of Integral Circuits, i.e. SRAM, DRAM, FLASH, and LOGIC. He is responsible for Product Reliability/quality assurance to insure that the Integral Circuits within the Semiconductors meet international specifications.

**Obituaries.** **Sam Worcester** passed away Nov. 3, 1998 after having retired from Montana Tech at the end of June. Sam earned his B.S. in Metallurgical Engineering from Montana Tech and his M.S. in Metallurgical Engineering from Rensselaer Polytechnic Institute in Troy, NY. He served in the Air Force in the Light Metals Branch at Wright Patterson Air Force Base, and received an Air Force Commendation Medal. From 1961 through 1975 he held various positions from Research Metallurgist to Chief Metallurgist, Technical Director, and Vice President for Technology at Teledyne Wah Chang, Albany, OR, followed by the positions of Chief Metallurgist and General Manager at Western Zirconium. He managed manufacturing and technology at Westinghouse Electric Corp.'s Commercial Nuclear Fuel Division in Ogden, UT. He developed a number of processes, 17 of which resulted in patents. In 1989, he began his career at Montana Tech as an Associate Professor of Metallurgical Engineering, Director of Research and Dean of the Graduate School in 1989. Sam also served as the Director of the Center for Advanced Metallurgical and Mineral Processing. In 1995, he

returned to teaching full-time and became head of the Metallurgical Engineering Department. Surviving are his wife, Kathryn, son and daughter-in-law, Steven Samuel and Lisa Worcester; daughters and sons-in law, Stephanie Ann and Dan Duce, and Suzanne Ebba Worcester and Steven Moore; and granddaughters, Meredith and Adrienne Duce. Sam was a member of the Presbyterian Church, and a member of the Greenway Planning Committee. A lover of music, Sam enjoyed playing the trombone, and was an active member of the Butte Symphony. After retirement, Sam and Katy relocated to Ashland, OR, where he was becoming active in the community and in the local Shakespearean festival. In Sam's memory, Kathryn established the S.A. "Toby" and Sam Worcester endowed scholarship fund through the Montana Tech Foundation.

**Harold "Tweek" Treweek**, who graduated with a degree in Metallurgical Engineering from Montana School of Mines, passed away in Lakeland, FL in 1998. In addition to his career in metallurgical engineering, which focused on flotation, he became an accomplished marksman and enjoyed photography and travel with his wife, Jessie, who he married on September 10, 1955. Born in Great Falls, MT on September 17, 1930, he followed in the footsteps of his father and grandfather, who were in the mining business. His grandfather, Nicholas Treweek, worked for Homestake Mining in Lead, SD. His father, Wilford Treweek, worked for the Anaconda Co. in Great Falls, MT. Harold was a Mill Superintendent for Cominco American in Philipsburg, MT, ASARCO, Jay, and retired from U. S. Silica, where he was a Quality Assurance Manager at their Kosse, TX plant. He also worked for Armour, a phosphate mill on Lake Hancock, and he was the Vice President of CFS Inc., in Lakeland, FL. He was known as an industry troubleshooter with WEMCO in Sacramento, CA. He was a co-holder of five U.S. patents relating to ore flotation and was the co-author of two American Institute of Mining, Metallurgical and Petroleum Engineers (AIME) publications on flotation. He loved his work and was very good at what he did. He was a staff sergeant in the Army and a veteran of the Korean conflict. Treweek was a member of the Masonic Lodge No. 35 in Butte, MT and of the Elks Lodge No. 1291 in Lakeland. He was a member of the Episcopal Church. He is survived by his wife, Jessie, Lakeland; son, William, Lakeland; and sister, Alice Crouch, Great Falls, MT.

**Lawrence Braunbeck** died at his home in Rocker, MT Friday, June 18, 1999, after a short battle with cancer. Born March 26, 1947, in Miles City, he was the son of John J. and Martha J. Yothers Braunbeck. He graduated from Sacred

Heart High School in 1965 with major involvement in music and the National Honor Society. Mr. Braunbeck went on to graduate from Montana Tech in Butte with an engineering degree in mineral dressing with honors. He went on to win the coveted Montana Engineering Award. In 1979, Mr. Braunbeck was selected as an Outstanding Young man of America by the United States Jaycees. He was employed by a number of major mining firms in Butte and Troy as well as firms in Arizona and Nevada. In later years, he became a consulting engineer and was in great demand for his engineering and finish carpentry skills. Larry enjoyed fishing, hunting, carpentry and gardening. He was affectionately known as "The Tomato Man." On Oct. 13, 1979, he and Kaye Zimmerman were married in Casa Grande, Arizona. His survivors include his wife, three children from a previous marriage: his son, Larry J. Braunbeck of Elko, NV; his daughter and son-in-law, Renata and Bill McLeod, of Coeur d'Alene, Idaho; and his daughter, Colleen Braunbeck, of Auburn, CA.

**Russell E. Hoar** passed away in Casa Grande, Arizona Sept. 29, 1997. His wife, Emily, has since relocated to Tucson. Mr. Hoar was born Sept. 1, 1934 in Butte, MT to Russell S. and Lillian (Graham) Hoar. He graduated from Butte High School in 1953 and Montana School of Mines in 1958 with a bachelor's degree in metallurgical engineering. He was an Army veteran and a metallurgical engineer in the mining industry before retiring. His metallurgical engineering career began in El Salvador, Chile, with the Andes Copper Mining Co. (owned by the Anaconda Co.). He was later employed at U. S. Steel's Research Lab, Provo, UT, and at U.S. Steel, Atlantic City, WY; MolyCorp, Questa, NM, Hecla Mining Co., Casa Grande, AZ, Inspiration Copper, Globe, AZ, Noranda Moining Co., Casa Grande, ASZ, Star West Mining Co. in Dewey, AZ, Kocide Chemicals in Casa Grande, AZ, and finally K. D. Consultants, for whom he traveled to Mongolia. He retired Jan. 1, 1997 and started his own consulting company, which took him back to Chile. He enjoyed fishing, crossword puzzles, computers, sporting events and especially his family. Russ was a very honest man, and he expected the same of everyone else. He is survived by his wife of 38 years, Emily (Wilson); two sons, Russell E. Graham of Tucson and Ken Hoar of Las Vegas; a sister, Darlene Hart of Butte; and three grandchildren. The family of Russell E. Hoar has established a memorial scholarship in his name, which will be used to benefit the next generation of Montana residents interested in Metallurgical Engineering.

**Stiles R. Slosson**, class of 1951, passed away at his home in Seattle, WA on December 29, 1999.

## A Message from the Department Head

I hope you have enjoyed this newsletter. You can certainly see that a lot has happened this past year and a lot of it due to higher education changing and our need to change with it. The name of the game has become "generate FTEs" seemingly meaning to take any warm body we can get our hands on. This is a threat to graduating "good" students like we have in the past and will therefore be a threat to our continued 100% placement as a result. We need to recruit students and simultaneously make sure those students are good. This will happen through increased recruiting efforts associated with good scholarships. Scholarships are needed to help recruit as well as retain. I think you can appreciate our cry for increased recruiting and scholarship help in this regard.

Complicating the matters is our current inability to replace retiring faculty. Key people like Vern Griffiths need to be replaced so that a broad program in Metallurgical Engineering can be offered, such that students still have a choice to the courses they take. When I came to this department, I replaced Gordon Zucker. When Carl came, he replaced Sam Worcester. Ted Jordan and now Vern Griffiths have not been replaced and thus our ability to remain flexible has greatly diminished. We have accommodated this as best as possible by changing the program. We think you will agree that, under the circumstances, the new program looks good and is just as strong as before. However, it would be more desirable to have strength in faculty numbers. That not only benefits the program; it is critical to attracting students and reinforces the graduate program and research. I think you can appreciate our cry for endowment help in this regard too.

Having read all this, you might like to know what plans we have in mind with your help. Obviously, we hope to continue on the success of the Foundation Phonathon via coordination with the fund-raising letter. In this regard, the success of Metallurgical Engineering Student Excellence Program MESEP has been outstanding and something we hope to grow. Consequently, we would like to add two new endowed scholarships to recruit and retain students in the MetE program. These would also be used to honor (by naming the endowments with their names) two of our Emeritus Professors: Vern Griffiths and Gordon Zucker. As you know, Vern taught physical metallurgy/materials engineering here for 40 years and is more than deserving. Likewise, Gordon taught mineral processing/engineering science here for 20 years and continues to come back to teach and visit. We also plan to purchase a new SEM/EDX. Donations through the Foundation and indirect returns from research efforts are slowly accumulating to do this but the account was recently raided in order to repair its turbo-vacuum pump and computer board. Vern and Bill are doing an excellent job keeping the 20-year old SEM/EDX operational. Other plans are too minor to discuss in comparison to these efforts.

You also deserve to know what we plan to do and are doing outside of your help. We will be contacting high-school students with high ACT/SAT scores, particularly those who show interest in common disciplines such as materials or chemical engineering. We are actively recruiting "undecided" students on campus, which is exemplified by the new seminar format discussed earlier in the newsletter. We are making visits to regional high schools (not just Montana) with more frequency. For high schools outside the region (as in across the nation), we will distribute recruiting posters and other promotional materials. We will attempt to teach high-school teachers the value of the mining industry in hopes they will spread the truth about it, and much, much more. In short, we do not and will not depend only on you; however, any help you can give will be and is greatly appreciated.

Please understand that we do not look at this as doom and gloom. It is merely a temporary phase that we must endure in order to come out for the best. And we will; together, we will!

We hope all is well with each of you. Please drop us a brief note to let us know what you have been doing since it is hoped to include more alumni news in the newsletter. We also would prefer to do this using electronic media so if you could let us know your e-mail address, assuming you have one, we would appreciate it. Rosalie's e-mail is [rmurphy@mtech.edu](mailto:rmurphy@mtech.edu). The MetE office phone and fax numbers are (406)496-4133 and (406)496-4664. Take Care and Thank You once again for your support!